

"THE DEVELOPMENT OF  
THE WASHINGTON, BALTIMORE & ANNAPOLIS RAILWAY"

Edward Elick Norris 1/7/28 [on Eleck E. Norris]

The Washington, Baltimore & Annapolis Railway was opened for service between Washington and Annapolis February 7th, 1908 and between Washington and Baltimore April 2nd, of the same year. The first car of the system arrived at the Baltimore terminal at 11:05 P.M. Thursday March 19, 1908. As the car passed into the station excitement was aroused by a cloud of smoke rolling from beneath the center of it, followed by flames, which were due to the overheated condition of the machinery. It was explained that the machinery became overheated on account of the large amount of sand and dirt on the tracks within the city limits. Damage to the car was slight and the trial trip pronounced a success. It was found that the car worked perfectly and cleared all corners and curves in good shape. The trip was made from the shops at Odenton where the car returned that night. The road has lines over two different routes between Baltimore and Annapolis and the main line between Baltimore and Washington. The two Annapolis lines serve the home of the United States Naval Academy and the intervening territory much of which is suburban to Baltimore. Annapolis and the intermediate territory to Baltimore are served solely by the W. B. & A. both for passengers and freight.

The plant installed by the railroad for operation of the line cost in the neighborhood of \$11,000,000 and the track over which it operates approaches a straight line and is several miles shorter than the shortest steam road. The rails weigh 80 pounds to the yard and are within 16



pounds of being as heavy as the heaviest used on the best of the standard steam roads. Bridges are made of steel or concrete; culverts are of concrete, and stone ballast is used. There are few curves, and grade crossings have been avoided. The operation of this road has resulted in greatly increased traffic, both freight and passenger.

The Washington, Baltimore & Annapolis Railroad is of exceptional interest both on the score of its having been converted from a 6600 volt single phase to a 1200 volt direct current road, and on account of the class of service it is providing.

The main line between the two major cities is the backbone of the service, and revenue of the company. The intervening territory is sparsely settled and hence the need is naturally for high-speed infrequent-stop service.

The special feature of the Alternating Current system first used was the use of single phase alternating current in generators, transmission lines, trolley car equipment and motors which constituted a wide departure from the then prevalent type of railway apparatus which was wholly on direct current.

An A.C. system, in order to operate as efficiently as a D.C. system, must be single phase to provide a single supply circuit and, the motor must have the characteristics of the D.C. series motor which inherently lends itself to speed control. The type A.C. motor that was used is similar in construction to a D. C. motor with its magnetic circuit laminated throughout and built in such proportions that it can successfully commutate alternating current. Such a motor is in effect a plain series



motor and will have about the same torque characteristic whether operated on A.C. or D.C.

The test made on the motors both in the testing room and under a car showed good efficiency and torque curves comparable to those of a good D.C. motor. The average power factor of the motors was approximately 96 percent.

Single phase alternating current was supplied at a frequency of 16 and  $2/3$  cycles per second. Current was normally fed in by one trolley, however, within the limits of the District of Columbia two trolleys were employed as by Act of Congress the use of rails as conductors was prohibited in the District, presumably on account of electrolysis. In this case the trouble, of course, would not exist but the contracting company was not able to obtain permission for the grounded circuit.

The alternating current to the car was carried through a main switch on the car to an auto-transformer connected between the trolley and the return circuit. At about 300 volts from the ground a lead was brought out from the transformer and passed through an induction regulator to one terminal of the motors. For starting and controlling the speed the induction regulator was used with its secondary winding in series with the motors. This secondary circuit of the regulator can be made to add to, or subtract from, the transformer voltage, thus raising or lowering the voltage impressed on the motors. The regulator therefore does double duty.

There were four motors of 100 n.p. on each car, the full rated voltage being about 220 volts. The motors were arranged in two groups of two in series in parallel. The motors were connected permanently in



this manner. As voltage control was used there was no necessity for series-parallel control as with D.C. motors. To insure equal voltage to the armatures in series, an equalizing action was obtained by the use of a small auto-transformer connected permanently across the two armatures in series with its middle point connected between them. The fields were arranged in two pairs, with two fields in series and the two pairs in parallel. This parallels the fields independently of the armatures and allows the use of one reversing switch for all four motors and one balancing transformer across the armatures.

In the W. B. & A. contract the Westinghouse Electric Company guaranteed that the efficiency of their system would be equal to that of a D.C. system with rotary converter substations. The loss in the rail return of an A.C. system should be relatively high but the higher trolley voltage reduces the current so much that the A.C. rail loss is practically the same as with direct current at usual voltages.

The use of this A.C. system continued until March 1, 1910 and was then discontinued in favor of a 1200 volt direct current system. This was due to the fact that at that time the use of A.C. was a new field and equipment had not been developed to efficiently use it. As previously stated the system was operated on 6600 volts A.C. Some difficulty was encountered then in insulating the trolley for this value of voltage.

An A.C. motor to give the same service as a D.C. machine must be much larger and draws a heavier current. This together with the fact that the pantograph type of current collector was unknown and the trolley wheel is limited to 400 amperes at speeds around 40 miles per hour,



which value of current was often exceeded in this system, caused maintenance of the trolley to become a source of considerable expense. In addition, quite heavy line surges, caused by switching, occurred and could not be taken care of, at that time, because lightning arresters had not been developed to the point where they could handle such values of voltage. These surges often ran back to the substations burning out transformers and blowing circuit breakers to pieces. Another disadvantage arising from the use of A.C. equipment is the large motors that are needed requiring a much heavier car.

The operation of the new D.C. system began March 1, 1910. The energy for operating the W. B. & A. is generated in the Bennings Power house of the Potomac Electric Power Company and is delivered to the Bennings substation at a potential of 6600 volts. There are five substations located on the road at the following points: Ardmore, Naval Academy Junction, Baltimore, Annapolis, and Bennings. Figures 2-3 and 4 show the relative positions of, and the distances between, these substations, as well as the manner in which they are connected electrically. The Bennings substation receives power from the Potomac Power house at 6600 volts, transforms it to 33,000 volts and distributes it at this potential to the duplicate transmission lines which feed the other substations of the system. There are no 1200 volt feeders from this substation. The Ardmore substation is the only one built for the 1200 volt system. The single phase substations in each of the other cases have been altered to suit the new conditions. Both of the 33,000 volt lines are tapped to the Ardmore substation and switching arrangements are provided to permit of either of



the lines being used. The potential is stepped down from 33,000 to 370 volts and fed to the rotary convertors, whence it is fed in both directions to the trolley and feeders at 1200 volts.

The Washington, Baltimore & Annapolis Railroad, during the period in which it was developing, was hampered in many ways, Competition, indifference on the part of the travelling public, and largely by the high cost of operating on alternating current instead of the later established standard of direct current. The subsequent change to the latter resulted in a very substantial and continued reduction in the operating expenses of the company. The comparatively frequent and reliable service which the Company had by this time established between its terminal points--Baltimore, Washington, D. C., and Annapolis--its lower <sup>rates</sup> passenger <sup>notes</sup> than the competing steam railroads and the conveniences which it afforded for local travel had made a strong appeal to a large and regular class of passengers. Coincident with the increase in this branch of the service the freight traffic showed a steady and profitable improvement.

In consequence of these handicaps, however, it became necessary for the promoters of the company to reorganize its finances. In the original capitalization of the company, 1907 to 1911, we find the maximum capitalization outstanding during these first four years of its operation to be as follows:

\$3,000,000	First Mortgage 5% Bonds.
1,000,000	Second Mortgage Bonds.
2,145,000	Baltimore Terminal Mortgage Bonds.
5,783,000	Preferred Stock
<u>1,500,000</u>	Terminal Company Stock
\$13,428,000	Total Capitalization then outstanding



In the reorganization of 1911 the capitalization was reduced to the following basis:

\$5,144,000 First Mortgage 5% Bonds.

1,455,750 Preferred Stock.

3,000,000 Common Stock.

\$9,599,750 Total Capitalization then outstanding.

By this readjustment it will be observed that not only the capitalization was reduced but that the bonded indebtedness on the entire property was reduced from \$6,145,000 to \$5,144,000 and that the lien of the first mortgage bonds was materially strengthened by including under the lesser amount of the new mortgage not only all of the property, rights, franchises, equipment, etc., as originally pledged, but also the valuable real estate and terminal properties located in the center of the business district of the city of Baltimore which had formerly been covered by the lien of \$2,145,000 of Terminal bonds.

The Washington, Baltimore & Annapolis Railroad originally operated from Baltimore over their own double track line to the District of Columbia. However on February 15th, 1909 an announcement was made of the successful negotiation between the Washington Baltimore & Annapolis Railroad and the Washington Railway & Electric Company by which an agreement was reached, to so rebuild the tracks of the Columbian Line on H. Street, Massachusetts and New York Avenues that they would carry the interurban cars from its terminal at 15th & H Streets. When entering Washington over the rails of the Washington Railway & Electric Company it is necessary to change from the 1200 volt overhead trolley system to the 600 volt under current plow system.

The proposition to extend the Washington, Baltimore & Annapolis



line to the center of Washington met with universal support from all patrons of the road. Such representative people as Governor Brothers, Major Mahool, Major Claude, Cardinal Gibbon and many others lent their active support to the accomplishment of this result. It was expected that the tracks would be rebuilt and the cars running without change from the center of Baltimore & Annapolis to the center of Washington by the first of the year. The inconvenience of changing to and from city cars at the edge of town was thus entirely done away. All conveniences of railroad stations are maintained at the terminal at Washington including a ticket office, waiting rooms, baggage room and a large yard for storage and loading of trains and similar facilities are at Baltimore and Annapolis.

The Army Cantonment of Camp Meade was established adjacent to the lines of the company in the year 1917 and proved such a large source of revenues that a loop was instituted in the camp during the War period.

In February 1921 the company acquired the railroad properties of The Maryland Electric Railway Company known as the Annapolis Short Line which operated a line of road parallelling the Washington Baltimore & Annapolis Railroad for seven miles from the city of Baltimore and which extended to Annapolis on the north side of the Severn River. The Annapolis Short Line entered Baltimore over the tracks of the Baltimore & Ohio Railroad and leased terminal facilities at the Camden Station of the road.

Since the acquisition of the Short Line its trains enter Baltimore over the tracks of the Washington, Baltimore & Annapolis Electric Railroad from a connection at Shipley and use the new terminal of the latter company, obviating the maintenance of seven miles of track and the rental



of terminal facilities at Camden Station, resulting in a material saving in operating expenses. The Short Line Railroad serves the territory between the Severn and Magothy Rivers.

The total trackage operated is equivalent to 130 miles of single track, the main line from Baltimore to Washington being 40 miles; from Camp Meade Junction to Annapolis 20 miles; the Annapolis Short Line from Baltimore to Annapolis comprises 25 miles, add other miscellaneous mileage, including second track, is 44.5 miles. The entire system, with the exception of about 1.37 miles in the city of Baltimore is all private right of way.

The company owns a total of 148 cars of standard M.C.B. construction, which includes 32 electrically equipped passenger cars; 26 combination baggage and passenger cars, electrically equipped 56 passenger trail cars, 3 freight and express trail cars, equipped with control; 14 freight and express motor cars, electrically equipped; 2 box cars; 8 freight flat cars; 3 steel hopper bottom gondola cars; 3 refrigerator cars, and 1 line car. In addition it operates 15 electrically equipped passenger cars leased under car trust agreement by the Annapolis Short Line Railroad Company.

In April 1927 ten two-section articulated cars built by the J.G. Brill Company of Philadelphia Pennsylvania were placed in service on the line. These cars were the first of their type to be introduced in high speed service operation in the United States and open up a new chapter in the history of interurban electric railway.

The W. B. & A. was incorporated under the general railroad law of Maryland as the Baltimore Terminal Company; by amendment to its charter



changed its name, obtained additional powers, and acquired, through foreclosure, all the properties and franchises of the Washington, Baltimore & Annapolis Electric Railway Company, such amendment to its charter and the acquisition of the properties and franchises of such Railway Company being ratified and confirmed by the Legislature of Maryland, Chapter 461, Acts of 1912.

The provisions of the franchises under which the Company operates in Baltimore and Annapolis are favorable and their validity sustained. The Company operates in the city of Washington under an irrevocable contract with the Washington Railway and Electric Company, placed under the deed of trust securing the first mortgage bonds.

This railroad furnished rapid, regular and frequent service between the Cities of Baltimore, Washington and Annapolis, which, with the intermediate territory, have a population of about one and one-half million people.

Its principal source of revenue is the passenger business between the above-mentioned cities and many rapidly developing communities in the intermediate territory. The Severn River Districts served exclusively by its lines, are probably the most beautiful and desirable locality contiguous to the City of Baltimore, attracting many Baltimoreans who are establishing homes in that section, and are now becoming the most popular summer resort districts in this section of the country. The Company supplies half-hourly service from the heart of Baltimore to the entire district.

The City of Annapolis, which was the scene of many stirring ac-



tions during the colonial period as well as of many historical events of major importance in the early life of the Republic, retains many of its pre-revolutionary buildings, which, together with the United States Naval Academy, make it an objective for many tourists.

The Baltimore & Ohio Railroad and the Pennsylvania Railroad are competitors running many trains from terminal to terminal in 60 minutes or less. With its entrances to the terminal cities on public streets, the Washington, Baltimore & Annapolis trains require 1 hour and 30 minutes, but have the advantage of more central stations, and charge lower fares.

In recent years de luxe interstate busses between the cities have offered additional competition, and the country wide automobile expansion has affected this company the same as it has all railways. Despite all this the W. B. & A. has for a number of years carried annually 60 percent of all Baltimore-Washington common carrier traffic. Following the enormous peak occasioned by Camp Meade and other World War activities in this territory, the gross traffic has been decreasing consistently, although the 60 percent ratio has been substantially maintained.

The road also enjoys a freight business consisting mostly of the carriage of package freight, which in the year 1921 produced a gross revenue of \$300,000.00.



# BIBLIOGRAPHY

The Baltimore Sun March-April 1908.

Descriptive Pamphlets Published by the W. B. & A.

General Electric Bulletin, No. 4808.

Brill Magazine, Vol. 13, No. 1.

The Electric Railway Journal. March 26, 1927.

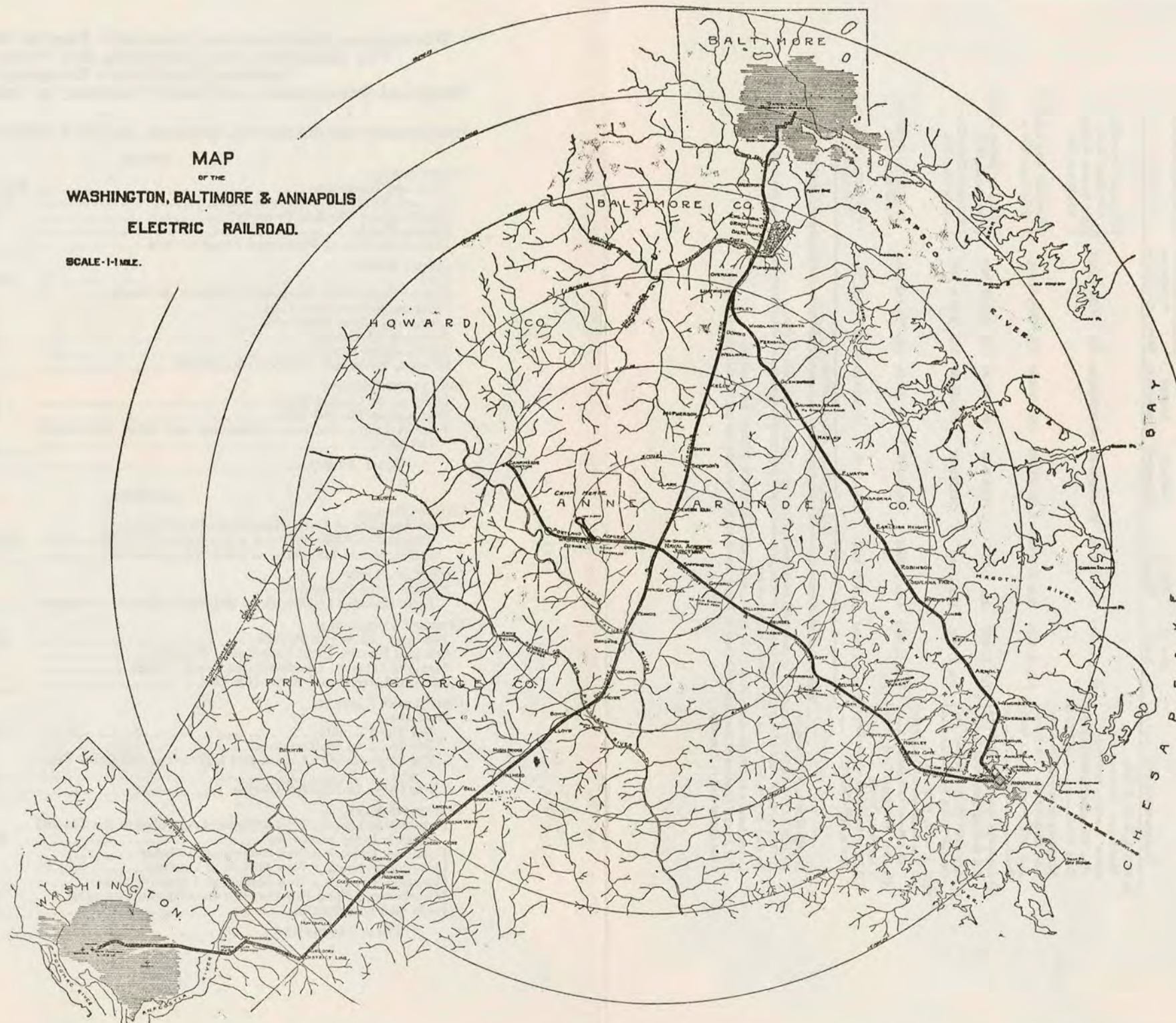
Electrical Engineering Papers by B.J. Lamme,  
Pp. 37-52.

Personal Interview with Mr. H.T. Connelly, General Manager  
of the Washington, Baltimore & Annapolis Railway.



MAP  
OF THE  
WASHINGTON, BALTIMORE & ANNAPOLIS  
ELECTRIC RAILROAD.

SCALE - 1-1 MILE.





**Washington, Baltimore and Annapolis Electric Railroad Company**  
And Subsidiary Companies

**CAPITALIZATION**

(SEE GENERAL BALANCE SHEET, PAGE 6)

**Capital Stock**

	Transfer Agent	Registrar	Par Value	Par Value Authorized	Par Value Issued
Common Stock	Fidelity Trust Co., Baltimore, Md.	Safe Deposit & Trust Co., Baltimore, Md.	\$50.00	\$3,000,000.00	\$3,000,000.00
Preferred Stock	Equitable Trust Co., Baltimore, Md.	Safe Deposit & Trust Co., Baltimore, Md.	50.00	2,500,000.00	1,760,500.00
				\$5,500,000.00	\$4,760,500.00

**Funded Debt**

Designation of Lien	Date of Issue	Date of Maturity	Amount Authorized	Amount Outstanding	Interest		
					Rate	Payable on first day of	At
W. B. & A. E. R. R. CO.							
Washington, Baltimore & Annapolis Electric Railroad Co. First Mortgage 5% Thirty Year Gold Bond-----	Mch. 1, 1911	Mch. 1, 1941	\$7,500,000.00	*\$7,308,000.00	5%	Mch. & Sept.	Cleveland Trust Co. Cleveland, Ohio. Safe Deposit & Trust Co. Baltimore, Md.
Baltimore & Annapolis Short Line Railroad Co. First Mortgage 5% Forty Year Gold Bond-----	Aug. 6, 1906	Aug. 1, 1946	1,000,000.00	1,000,000.00	5%	Feb. & Aug.	Alexander Brown & Sons, Baltimore, Md.
(1) Annapolis Short Line Railroad Co. Sinking Fund 7% Bond	Jan. 1, 1921	Jan. 1, 1936	732,000.00	645,000.00	7%	Jan. & July	Alexander Brown & Sons, Baltimore, Md.
(2) Annapolis Short Line Railroad Co. Car Trust Bond-----	Jan. 1, 1921	(See Note)	240,000.00	120,000.00	7%	Jan. & July	Maryland Trust Co., Baltimore, Md.
THE A. & C. B. P. CO.							
(3) The Annapolis & Chesapeake Bay Power Company.....	June 1, 1923	June 1, 1948	800,000.00	783,000.00	6%	June & Dec.	The Fidelity Trust Co., Baltimore, Md.
(1) First Mortgage Gold Bond Series "A"—6%.....							
(1) First Mortgage Gold Bond Series "B"—5½%.....	June 1, 1925	June 1, 1948	250,000.00	185,000.00	5½%	June & Dec.	The Fidelity Trust Co., Baltimore, Md.
			\$10,522,000.00	\$10,041,000.00			

(1) 2% Sinking Fund Clause.

(2) Mature \$24,000.00 on January 1 of each year, commencing 1922; the last mature January 1, 1931.

(3) The Annapolis and Chesapeake Bay Power Company first mortgage limits the principal amount of bonds which may be issued to \$5,000,000.00. To date only Series "A" and "B" have been authorized.

Denomination \$1,000.00, except A. & C. B. P. Co., which are of \$1,000.00, \$500.00, and \$100.00.

The Annual Meeting of Stockholders is held at Naval Academy Junction, Md., on the last Monday in March.

\*\$92,000.00 held in Treasury.



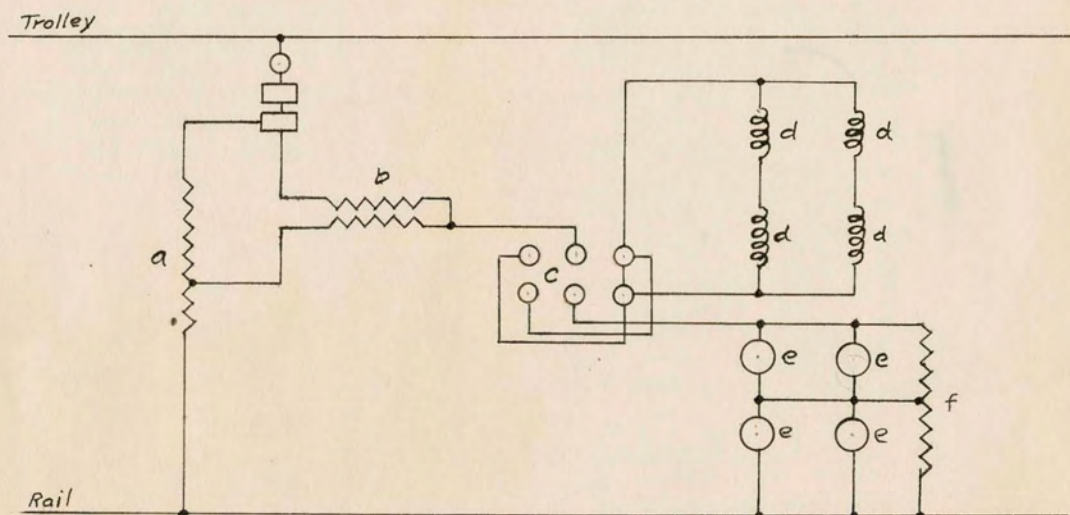
**Washington, Baltimore and Annapolis Electric Railroad Company**  
**The Annapolis and Chesapeake Bay Power Company**  
**Terminal Real Estate Company**  
**Maryland Development and Realty Company of Anne Arundel County**

**CONDENSED CONSOLIDATED GENERAL BALANCE SHEET, DECEMBER 31, 1926**

Assets		
INVESTMENTS:		
Road and Equipment.....	\$14,132,693.25	
Gas and Electric Light Properties.....	1,809,042.58	
Miscellaneous Physical Property.....	126,581.40	
Sinking Funds.....	44,700.83	
Deposits in Lieu of Mortgaged Property Sold.....		\$16,113,018.06
CURRENT ASSETS:		
Cash.....	\$394,301.18	
Special Deposits for Payment of Interest on Bonds.....	26,775.00	
Marketable Bonds—at Cost.....	298,635.80	
Loans and Notes Receivable.....	48,308.12	
Accounts Receivable.....	160,160.95	
Material and Supplies.....	156,584.20	
Interest, Dividends and Rents Receivable.....	3,489.60	1,088,254.85
UNADJUSTED DEBITS:		
Discount on Capital Stock.....	\$64,680.00	
Discount on Funded Debt.....	573,974.45	
Prepaid Rents, Insurance Premiums and Other Unadjusted Debits.....	67,381.83	706,036.28
TOTAL ASSETS.....		<u>\$17,907,309.19</u>
Liabilities		
CAPITAL STOCK:		
Book Liability at Date (None Owned by Carrier)—		
Common—60,000 Shares of a Par Value of \$50.00.....	\$3,000,000.00	
Preferred—35,210 Shares of a Par Value of \$50.00.....	1,760,500.00	\$4,760,500.00
LONG TERM DEBT:		
Funded Debt Unmatured—		
Book Liability at Date (Less \$92,000.00 Bonds in Treasury).....		9,949,000.00
CURRENT LIABILITIES:		
Accounts and Wages Payable.....	\$256,339.72	
Gas and Electric Light Consumers' Deposits.....	24,106.50	
Matured Interest, Dividends and Rents Unpaid.....	26,775.00	
Accrued Interest and Rents Not Due.....	146,234.70	453,455.92
UNADJUSTED CREDITS:		
Reserves—		
For Tax Liability.....	\$18,729.40	
For Deferred Maintenance.....	31,352.64	
For Depreciation of Road and Equipment and Other Property.....	1,138,579.88	
For Other Unadjusted Credits.....	107,555.99	1,296,217.91
CORPORATE SURPLUS:		
Revaluation (Arising from a Physical Appraisal of the Gas and Electric Light Properties).....	\$526,593.25	
Donation Towards a New Station at Holladay.....	400.00	
Donation Towards a New Station at Garland.....	300.00	
Donation Towards a New Station at Crystal Springs.....	356.64	
Miscellaneous Fund Reserves (for Injuries and Damages).....	115,333.68	
Profit and Loss Balance.....	805,151.79	1,448,135.36
TOTAL LIABILITIES.....		<u>\$17,907,309.19</u>



# Diagram of Connections of Car Equipment on A. C. System



a-Auto-Transformer    b-Induction Regulator    c-Reversing Switch  
 d-Field of Motor    e-Armature of Motor    f-Equalizing Transformer



SUBSTATION APPARATUS				
	ROTARY CONVERTERS		TRANSFORMERS	
	Number	Capacity Kws.	Number	Capacity Kws.
Bennings	1	500*	7	800
	1	1000*	1	1100*
			1	550*
Ardmore	4	300	6	160
Academy Junction	5	300	7	160
Baltimore	4	300	6	160
Annapolis	2	300	3	160

\*Units marked thus are for operating the District line.

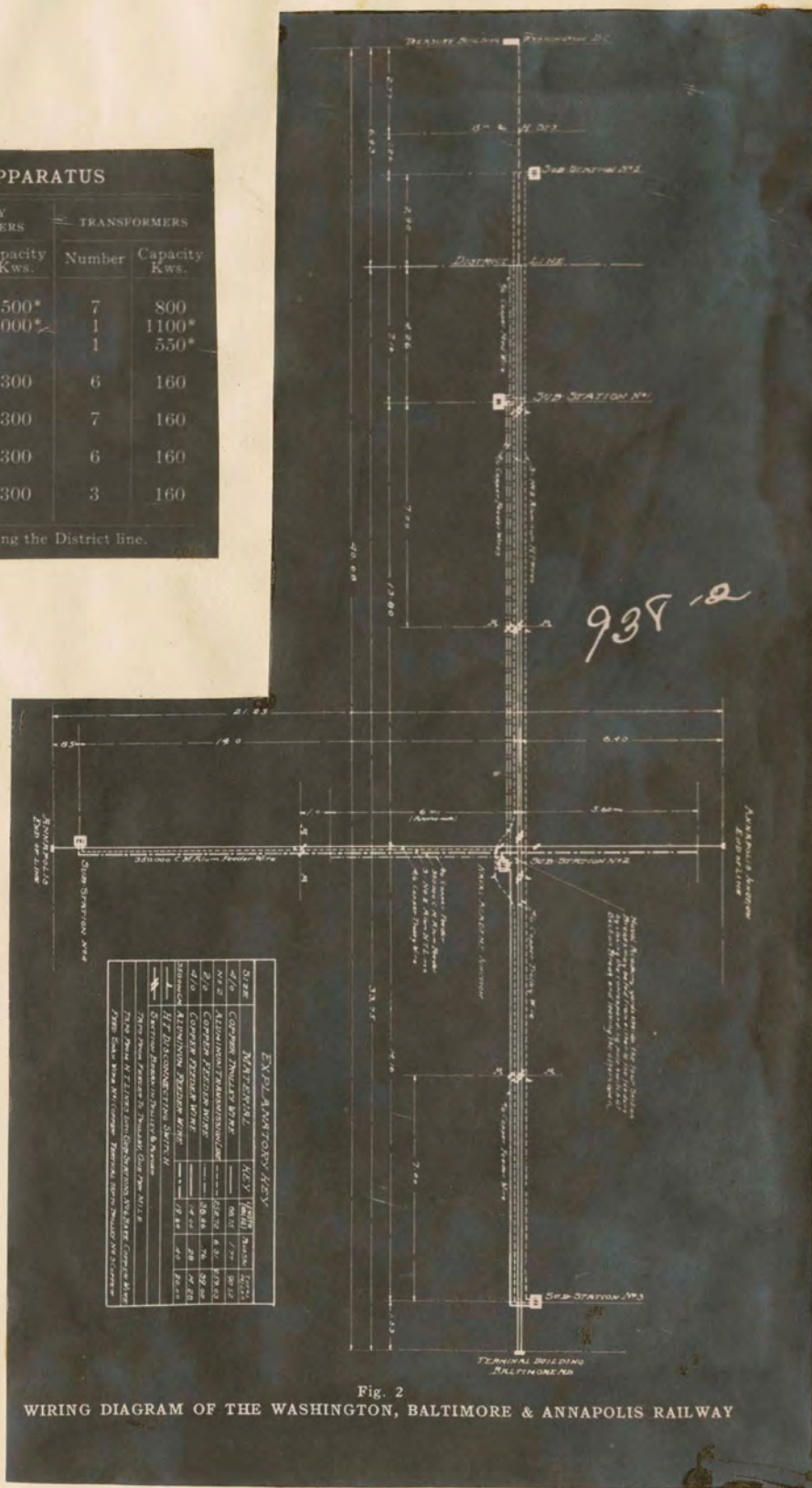


Fig. 2  
WIRING DIAGRAM OF THE WASHINGTON, BALTIMORE & ANNAPOLIS RAILWAY



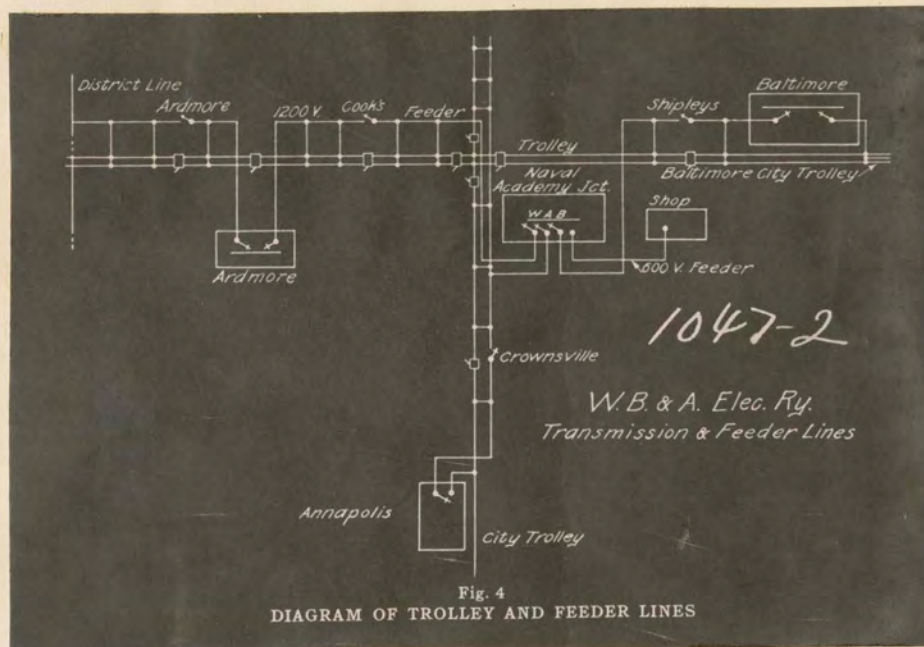
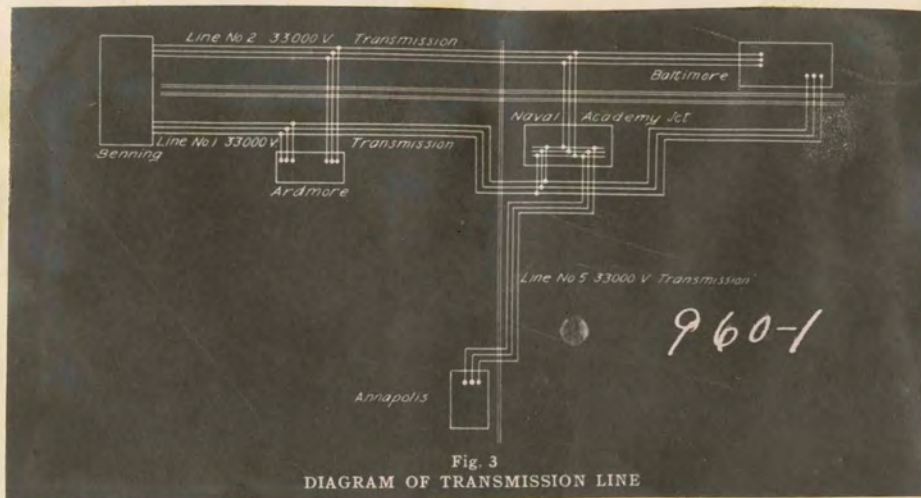






Fig. 5  
MAIN SECTION, ARDMORE SUBSTATION

Two 33,000 volt, three-phase incoming line panels.  
Two 33,000 volt, 600 kw. rotary converter panels.  
Two 33,000 volt aluminum cell lightning arresters.  
Two 600 kw, 1200 volt d.c. converter panels.  
Two 8 amp., 1200 volt d.c. feeder panels.  
One 750/1200 volt, D2 volt-meter on swinging bracket.

*Switchboard  
Equipment*

Four TC4-300-750-600/1200 volt compound wound rotary converters.  
Four 45 kv-a. oil-cooled reactive coils.  
Six H25-160-19,100/33,000 volt, "Y" 370/370 volt oil-cooled transformers.

*Station Equipment*



Fig. 6  
HIGH TENSION COMPARTMENT, ARDMORE SUBSTATION



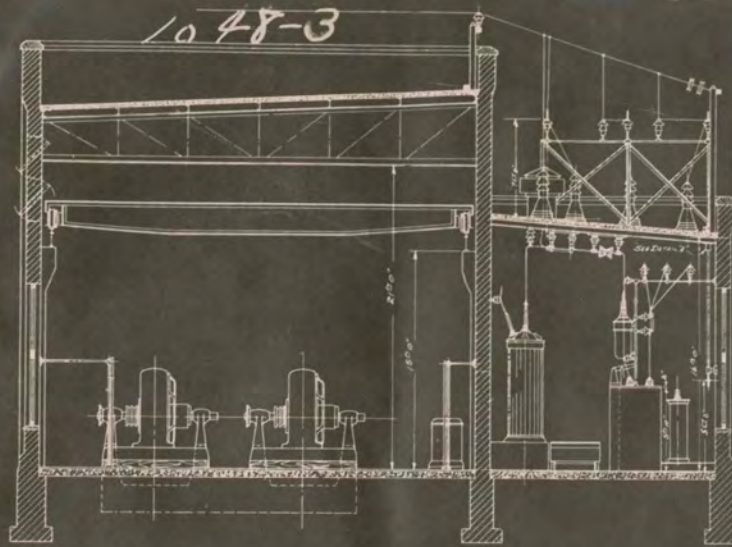


Fig. 7  
TRANSVERSE SECTION, ARDMORE SUBSTATION

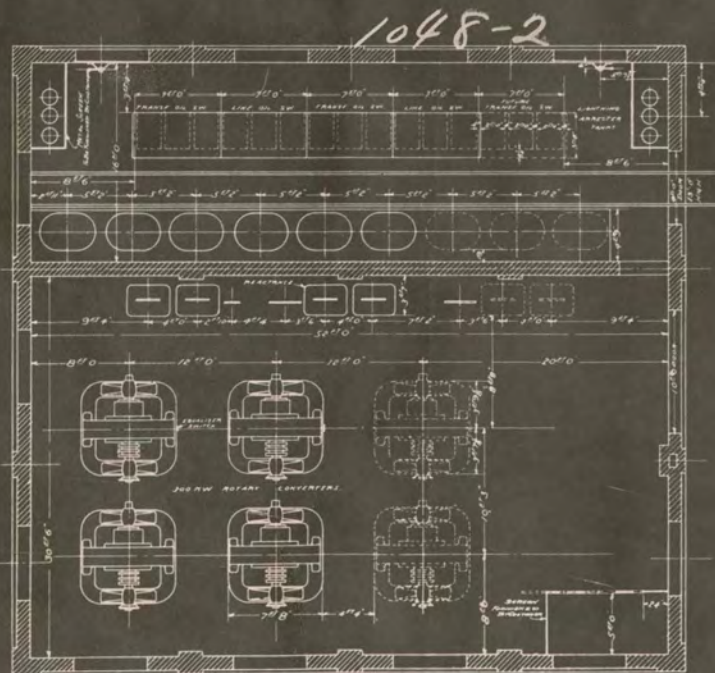


Fig. 8  
PLAN, ARDMORE SUBSTATION



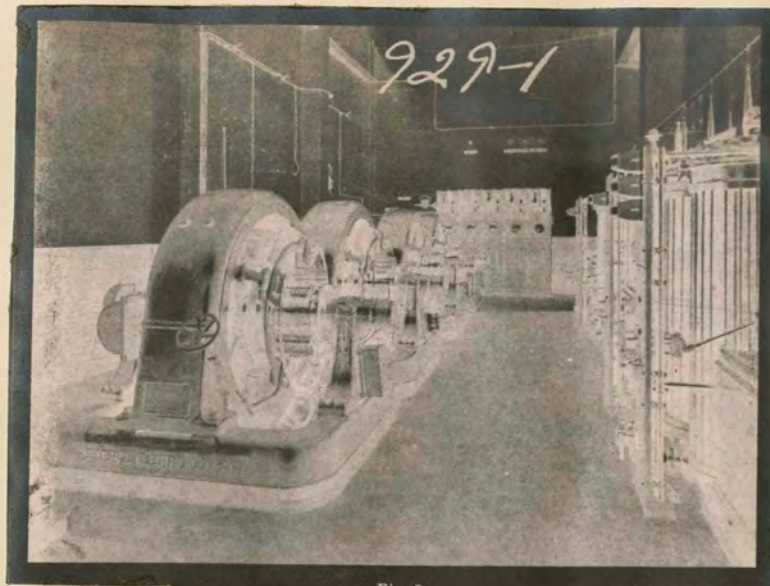


Fig. 9  
MAIN SECTION, NAVAL ACADEMY STATION

Two 33,000 volt incoming line panels.  
One 33,000 volt, three-phase outgoing line panel.  
Two 33,000 volt, 600 kw. a.c. rotary converter panels.  
Three 33,000 volt aluminum cell lightning arresters.  
Two 600 kw., 1200 volt d.c. rotary panels.  
Three 1000 amp., 1200 volt d.c. feeder panels.  
One 750/1200 volt D2 voltmeter on swinging bracket.

Five TC4-300-750-600/1200 volt compound wound rotary converters.  
Four 45 kv-a. oil-cooled reactive coils.  
Seven H25-160-33,000 "Y" 370/370 volt oil-cooled transformers.

### *Station Equipment*

### *Switchboard Equipment*

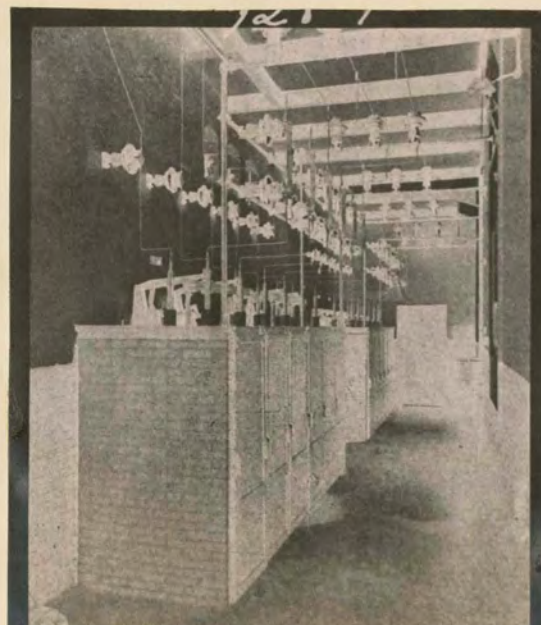


Fig. 10  
HIGH TENSION COMPARTMENT, NAVAL ACADEMY SUBSTATION



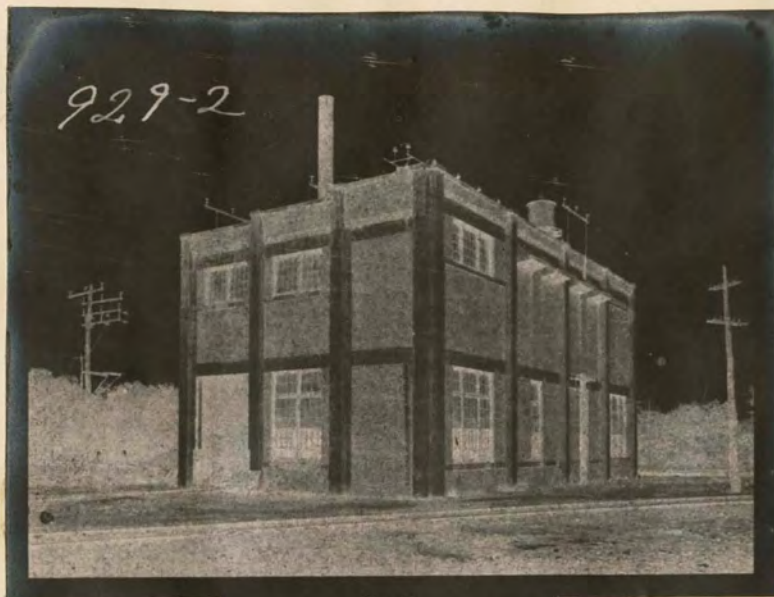


Fig. 11  
NAVAL ACADEMY SUBSTATION

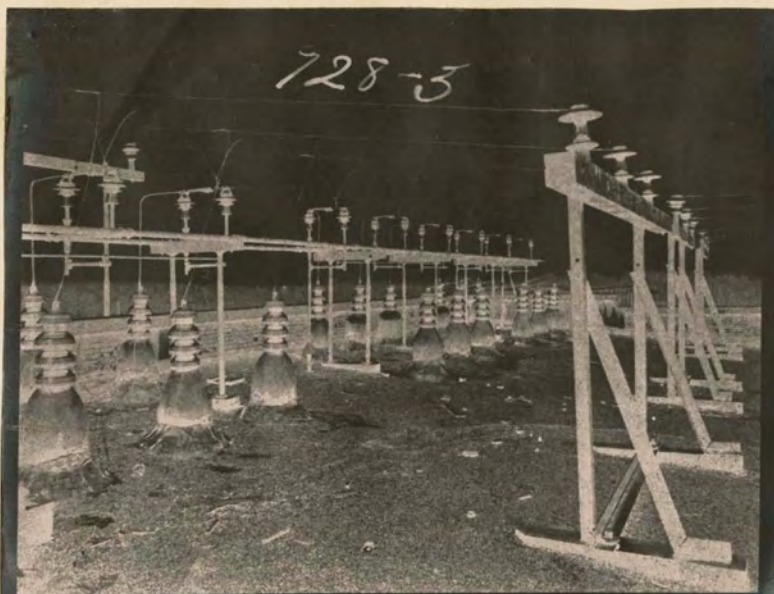


Fig. 12  
HIGH TENSION WIRING ON ROOF OF NAVAL ACADEMY SUBSTATION



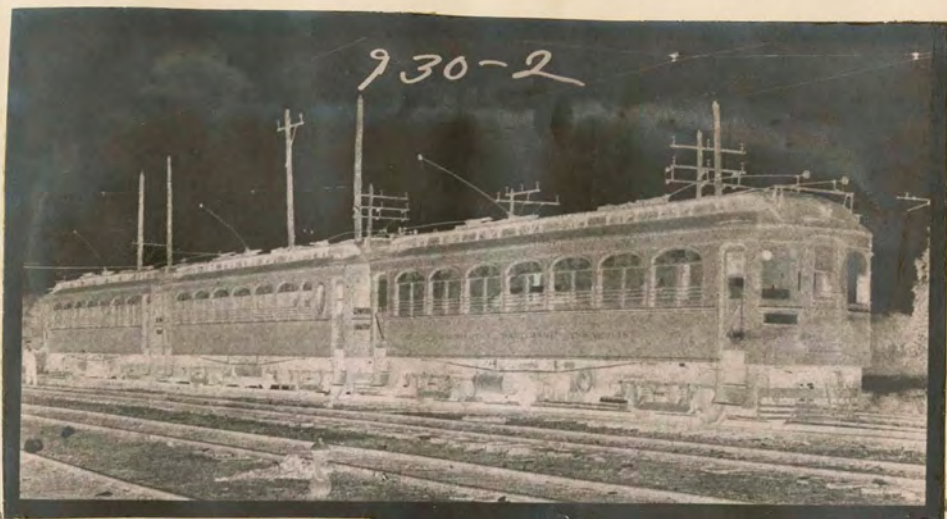


Fig. 19  
THREE CAR TRAIN

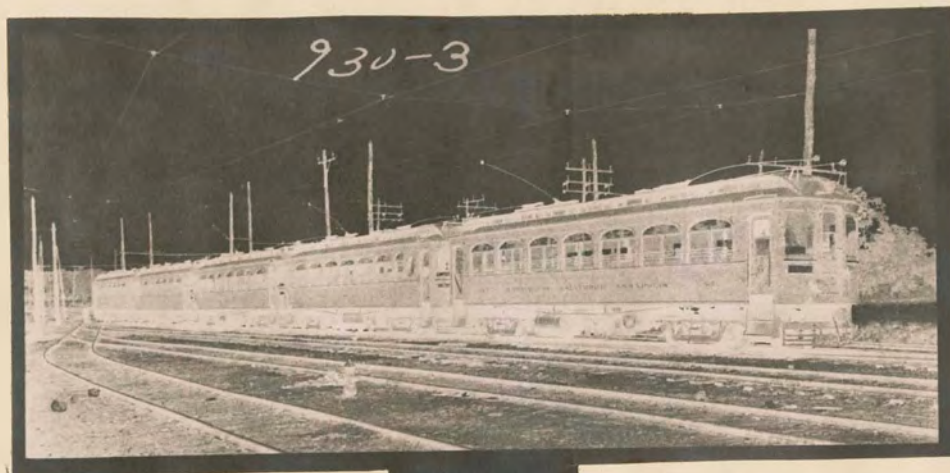


Fig. 20  
FIVE CAR TRAIN

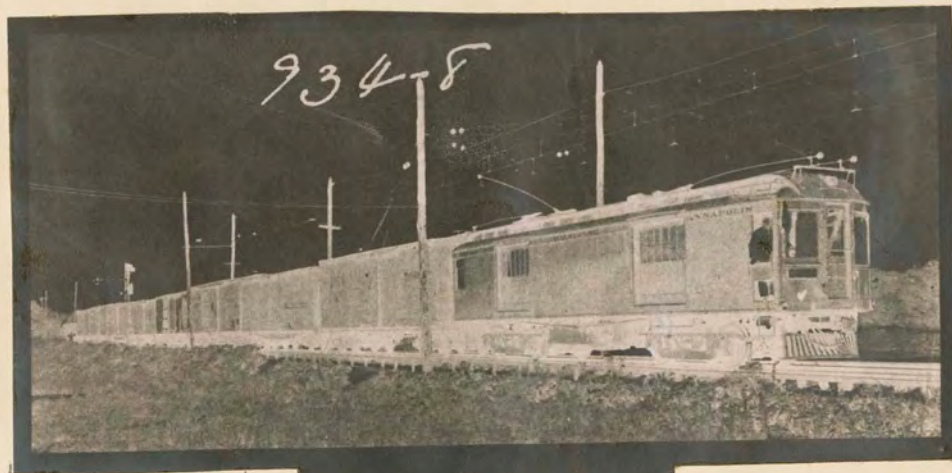
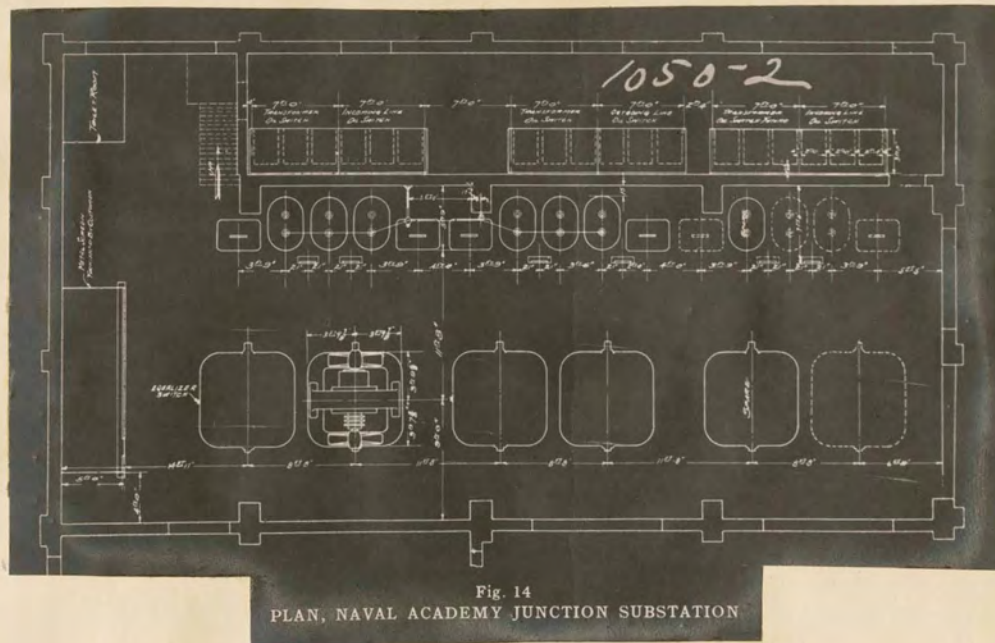
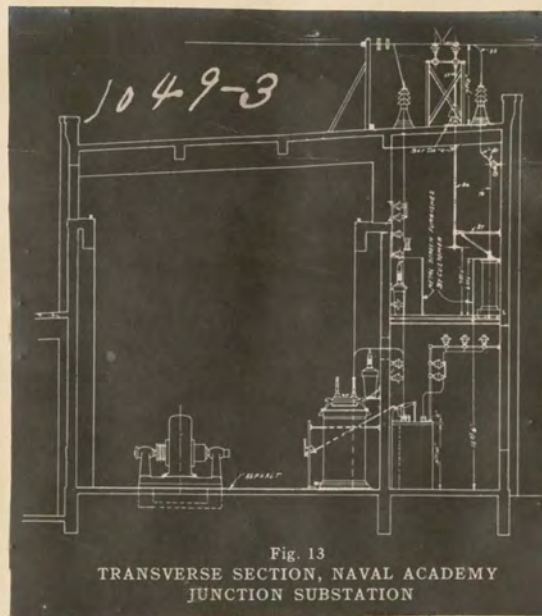


Fig. 21  
EXPRESS CAR AND FREIGHT TRAIN







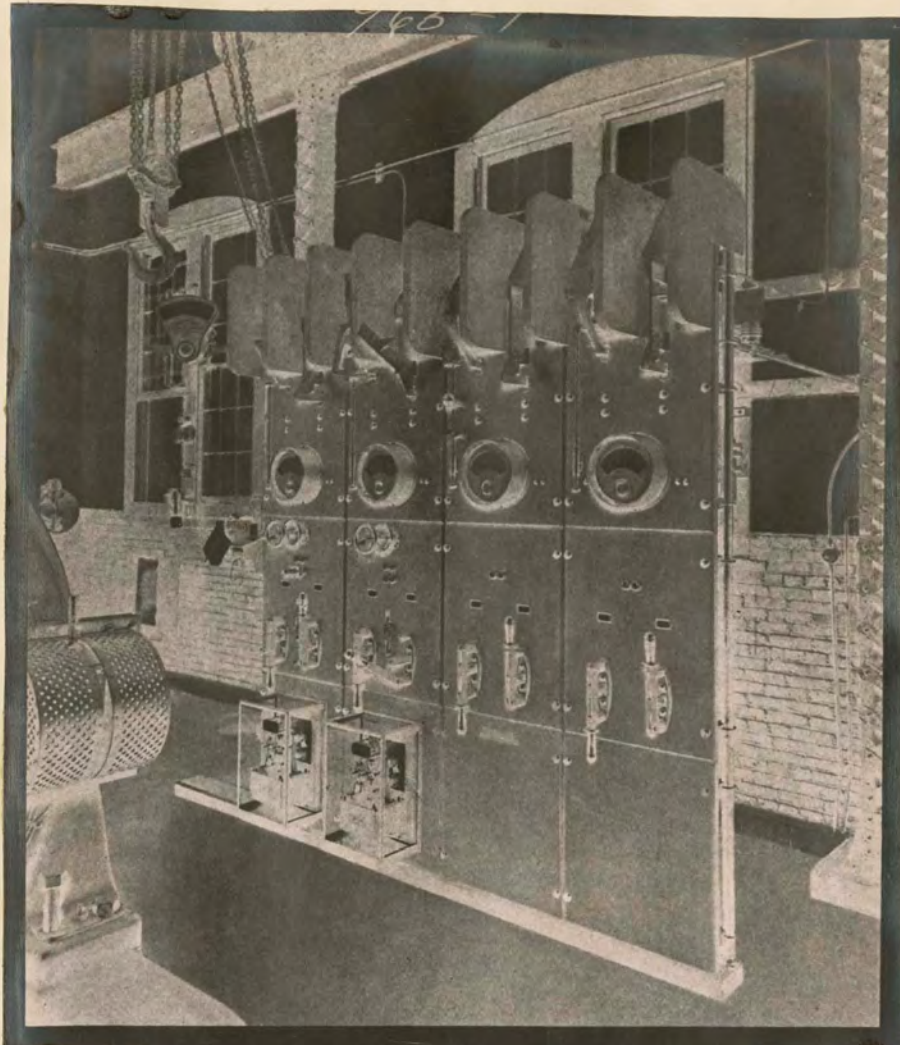


Fig. 15  
1200 VOLT SWITCHBOARD IN THE BALTIMORE SUBSTATION

Two 33,000 volt incoming line panels.  
Two 33,000 volt, 600 kw. a.c. rotary converter panels.  
Two 3000 volt aluminum cell lightning arresters.  
Two 600 kw., 1200 volt d.c. rotary panels.  
Two 800 amp., 1200 volt d.c. feeder panels.  
One 750/1500 volt D2 volt-meter on swinging bracket.

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*Station Equipment*



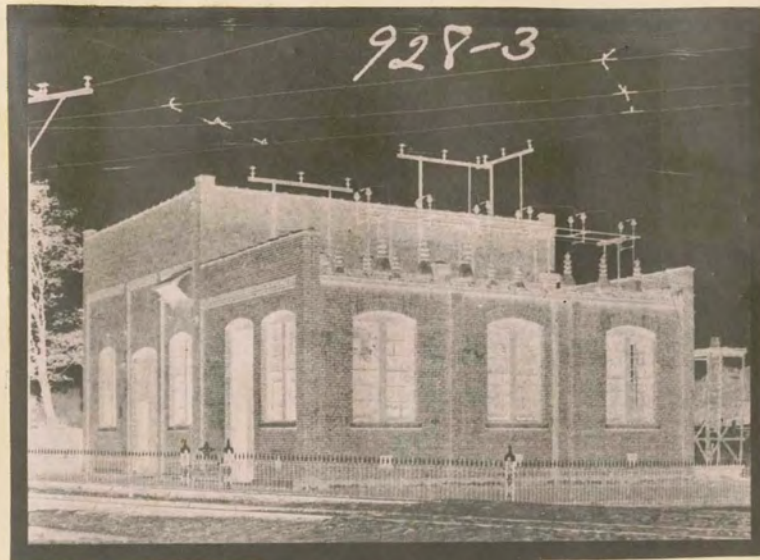


Fig. 16  
BALTIMORE SUBSTATION

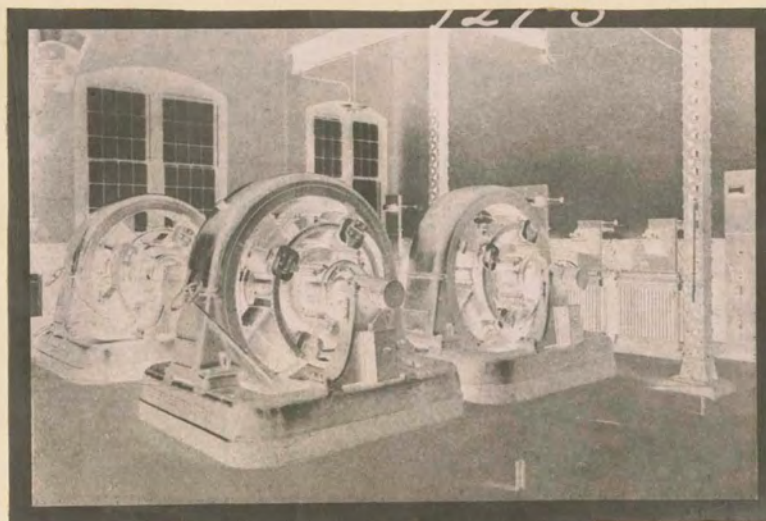
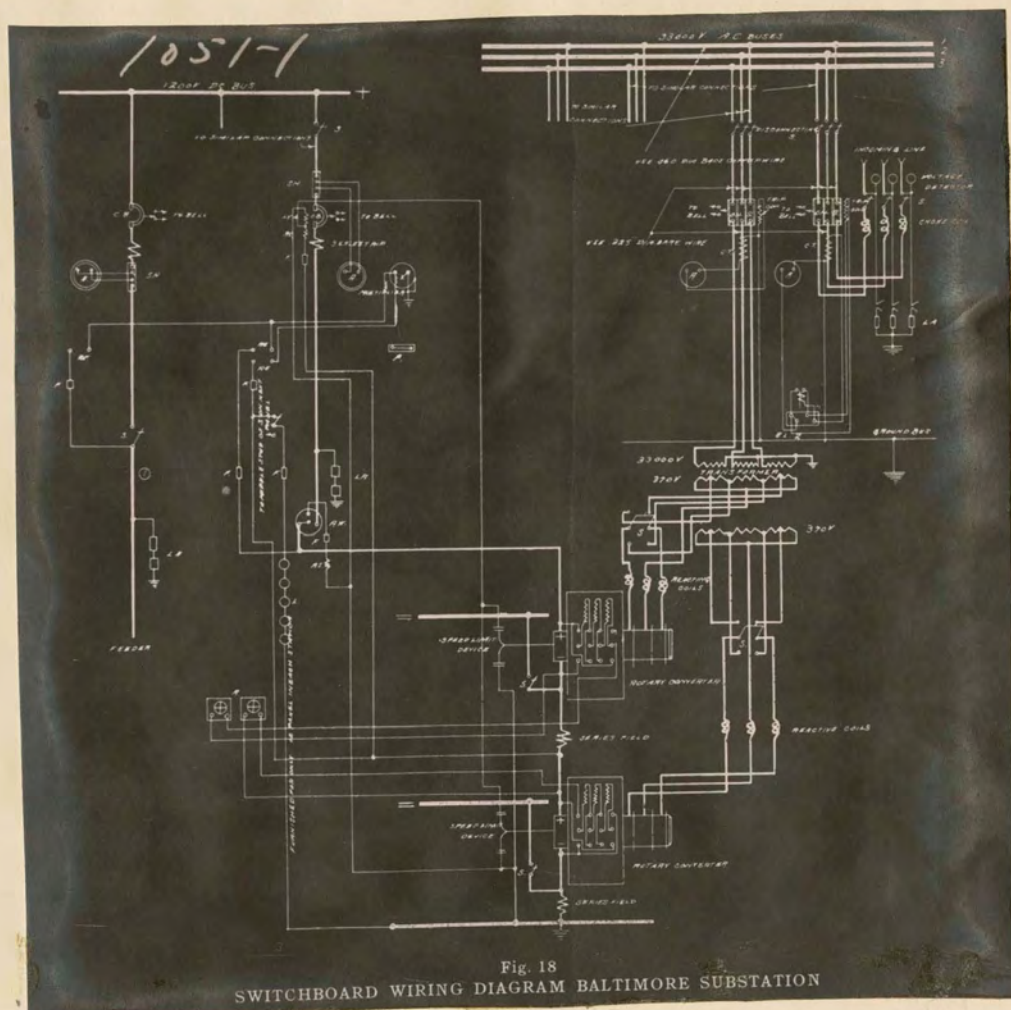


Fig. 17  
INTERIOR OF BALTIMORE SUBSTATION







Length over all	54 ft.	50 ft.
Height over all	14 ft. 1 in.	14 ft. 1 in.
Width over all	9 ft. 6 in.	8 ft. 8 in.
Weight of body	30,000 lb.	27,000 lb.
Weight of trucks (each)	13,000 lb.	13,000 lb.
Weight complete	86,000 lb.	83,000 lb.
Distance between truck centers	33 ft.	26 ft.
Wheel base of trucks	7 ft. 6 in.	6 ft. 6 in.
Diameter of motor wheels	3 ft. 1 in.	3 ft. 1 in.

### Details of Cars on Line



Fig. 22  
VIEW ALONG RIGHT OF WAY

Length over all	50 ft.
Length over body	40 ft.
Width over all	8 ft. 9 in.
Height from sills to top of roof	9 ft. 4 1/2 in.
Height from track to top of roof	12 ft. 9 1/2 in.
Weight of car body	28,500 lb.
Weight of trucks (each)	10,000 lb.
Weight complete ready for service	78,000 lb.
Type of truck	Baldwin class 78-25 A
Distance between truck centers	28 ft. 8 in.
Wheel base of truck	6 ft. 6 in.
Diameter of wheels	36 in.
Seating capacity	54

### Details of Locomotives

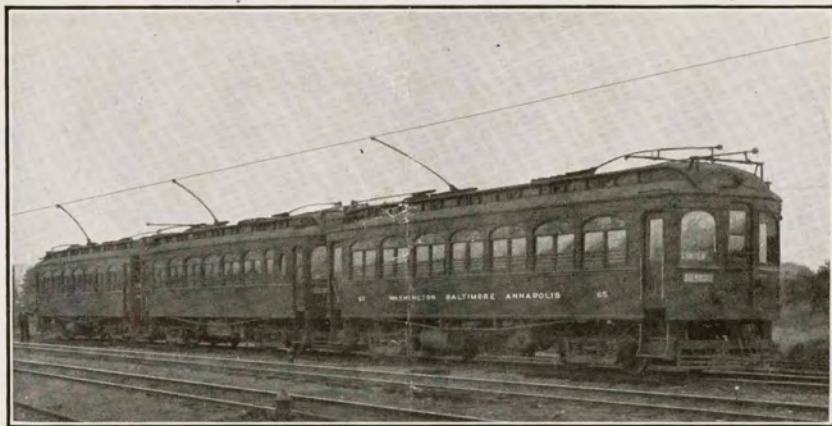


Views of the New Terminal Station and Yard at Baltimore





Naval Academy Junction

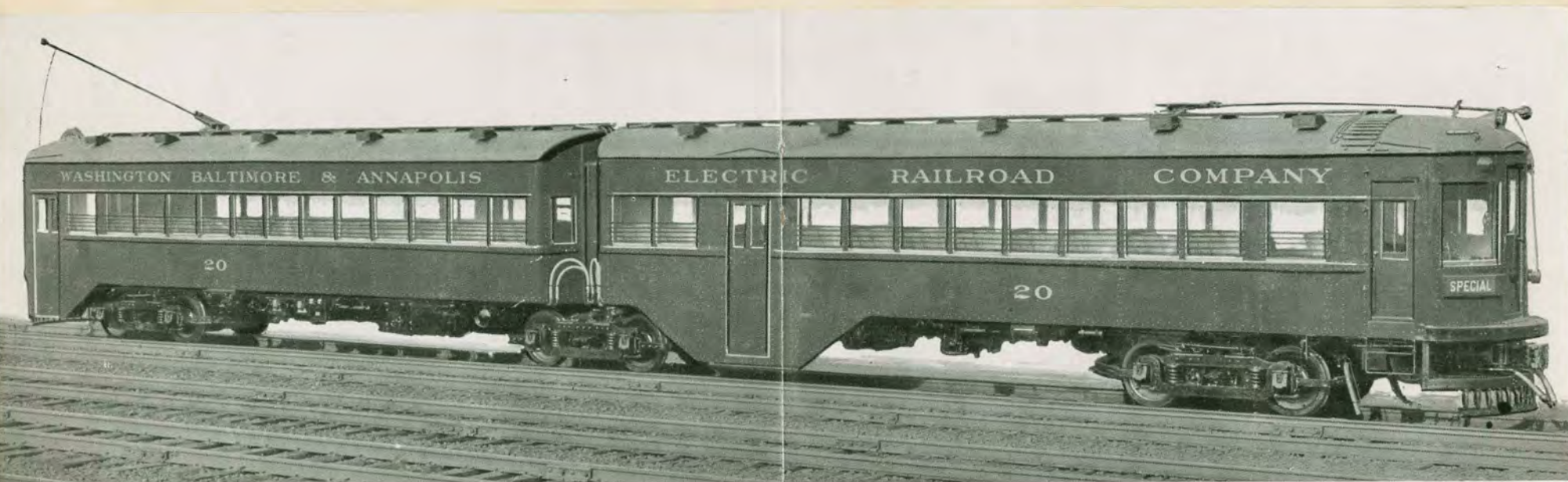


Type of Equipment

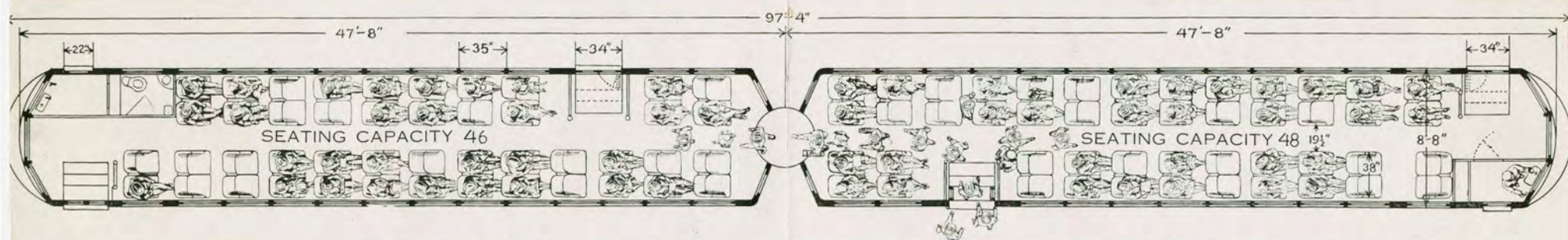


The Viaduct—built to eliminate dangerous grade crossings



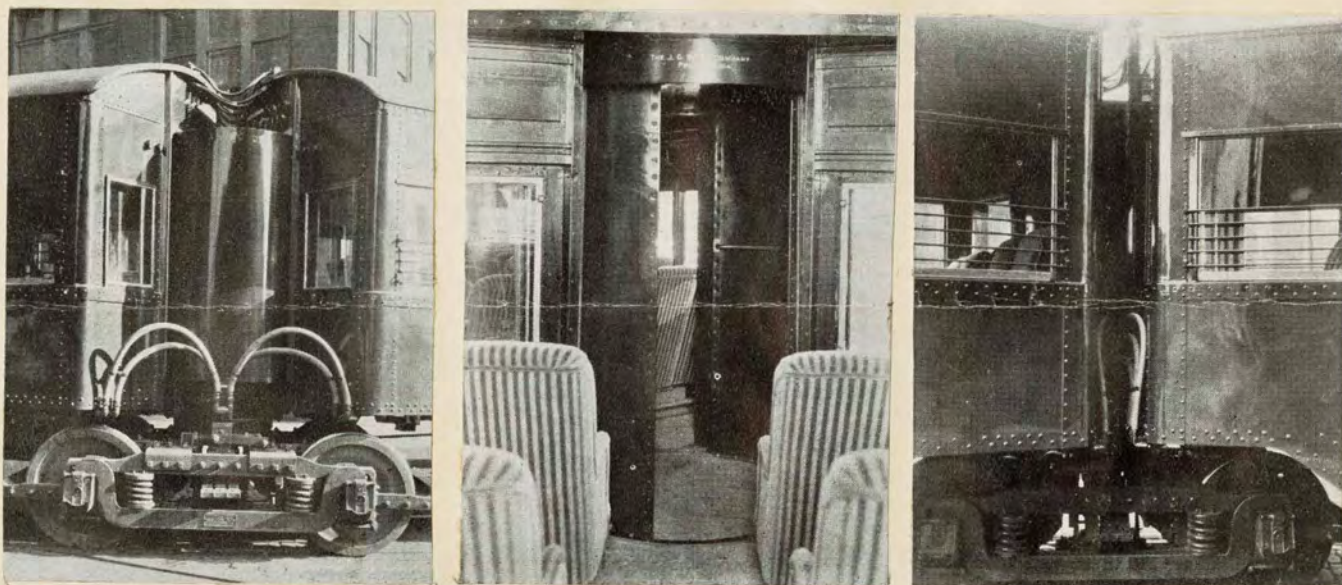


W. B. & A. ARTICULATED CARS. Mounted on three Brill 27-MCB-2 trucks, with motor equipment on the end trucks only, the complete unit weighs only 116,770 lb.

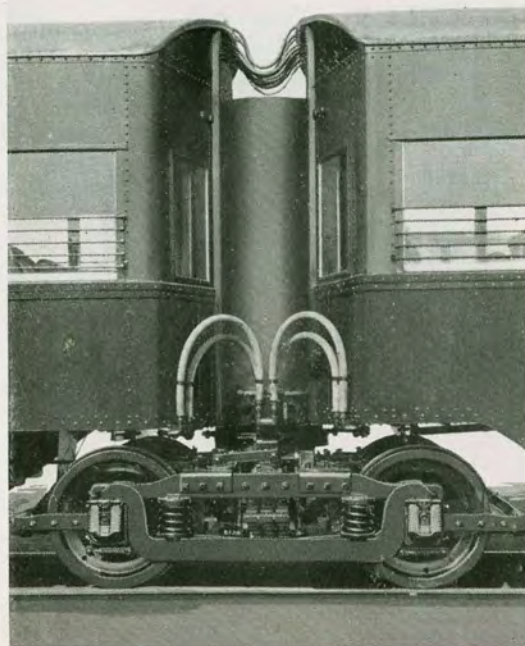


W. B. & A. ARTICULATED CARS. Height, track to under side of side sills, 3 ft. 6  $\frac{3}{4}$  in.; under side of side sills over trolley boards, 9 ft. 5 in.; floor to center of headlining, 8 ft. 1  $\frac{1}{2}$  in.; track to first step, 16 in.; risers, 11  $\frac{1}{2}$  in. Weight, body less electric and air equipment, 59,230 lb.; electrical equipment, 5,850 lb.; air equipment, 5,200 lb.; trucks, 31,090 lb.; motors, 15,400 lb.; total, 116,770 lb.





W., B. & A. articulated car easily negotiates the limiting curve of 50-ft. radius. View at the left shows the outer side of the car on the limiting curve, while at the right is illustrated the inner side. The center view shows appearance of the connecting drum opening shifted to one side, but still easily passable



W. B. & A. ARTICULATED CARS. The center truck without motors forms a support for the drum section through which passengers move from one section of the car to the other. Forming the support for the extreme end of each section this truck has a tendency to eliminate that "snaking" movement often characteristic of high-speed electric cars.





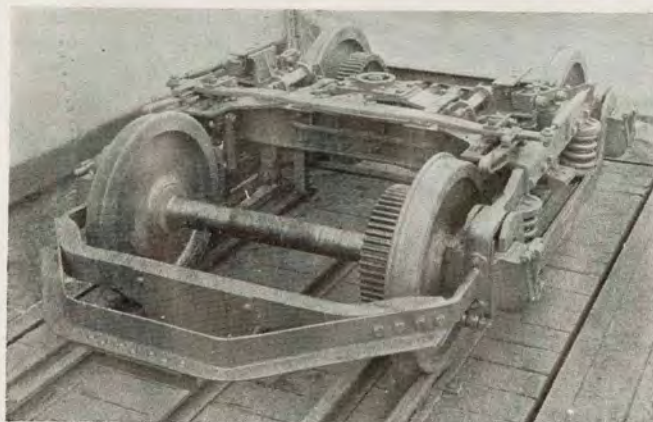
One of the first service trips of the W., B. & A. articulated trains



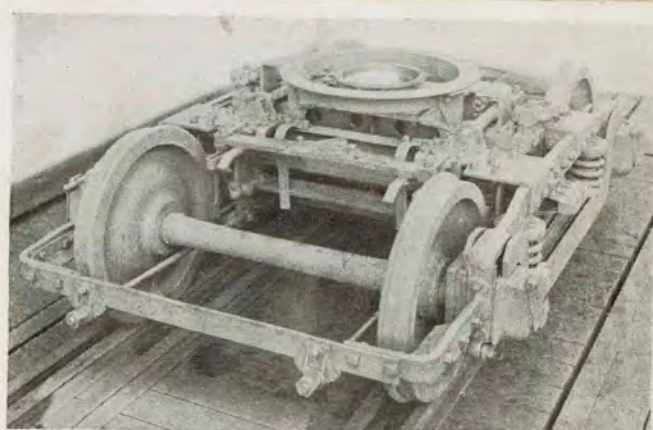
Looking through the drum from one body to the next

### General Dimensions and Specifications, W., B. & A. Articulated Cars

Length over all, each section...	48 ft. 8 in.	Seating capacity, section without saloon	48	Gongs	Brill dedenda
Length over vestibules, two-section unit	95 ft. 4 in.	Seating capacity, section with saloon	46	Grab handles	Ellcon type, mahogany, porcelain finish
Length over all, two-section unit	97 ft. 4 in.	Total seats	94	Hand brakes	Peacock tunnel type
Wheelbase, motor and pivot trucks	6 ft. 6 in.	Interior trim	Mahogany	Heaters	Railway Utility Company, truss plank No. 130
Width over posts	8 ft. 8 in.	Headlining and side lining	4-in. Agasote	Journal bearings	4 1/4 in. x 8 in.
Width over drip rail	8 ft. 10 in.	Air brakes	Westinghouse Traction Brake Company	Journal boxes	Brill
Width of each side door opening	2 ft. 10 in.	Car signal system	Consolidated Car Heating Company	Motors	Four Westinghouse 333-VV-8, inside hung on end trucks only
Height, rail to top of floor	4 ft. 2 1/2 in.	Car trimmings	Statuary bronze	Sanders	Ohio Brass Company
Height, rail to center line of coupler	33 1/2 in.	Compressors	Two Westinghouse D-2-K, 1,200-volt	Sash	Rex all-metal type
Height, top of floor to top of roof board	8 ft. 5 1/2 in.	Control	Westinghouse HL, double-end, 1,200-volt	Seats	Hale & Kilburn No. 900 double rotating chairs
Height, rail to top of roof	12 ft. 8 in.	Couplers	O-B Company Tomlinson No. 23 radial	Seating material	Chase frieze plush, pattern No. 188, gray No. 2,082, quality X
Height, rail to top of trolley board	12 ft. 11 1/2 in.	Curtain fixtures	Curtain Supply Company Rex	Step treads	Kass safety
Truck centers, each section	35 ft. 10 in.	Curtain material	Pantasote	Trolley retrievers	Ohio Brass Company
Distance center to center of side posts	2 ft. 11 in.	Destination signs	Illuminated, in dash	Trucks	Brill 26-MCB-2
Wheel diameter	36 in.	Door mechanism	National Pneumatic Company, not interlocked with control	Ventilators	Railway Utility Company
		Fenders	Steel pilots	Wheels	36-in. diameter, 3 1/2-in. tread
				Window glass	1/4-in. plate



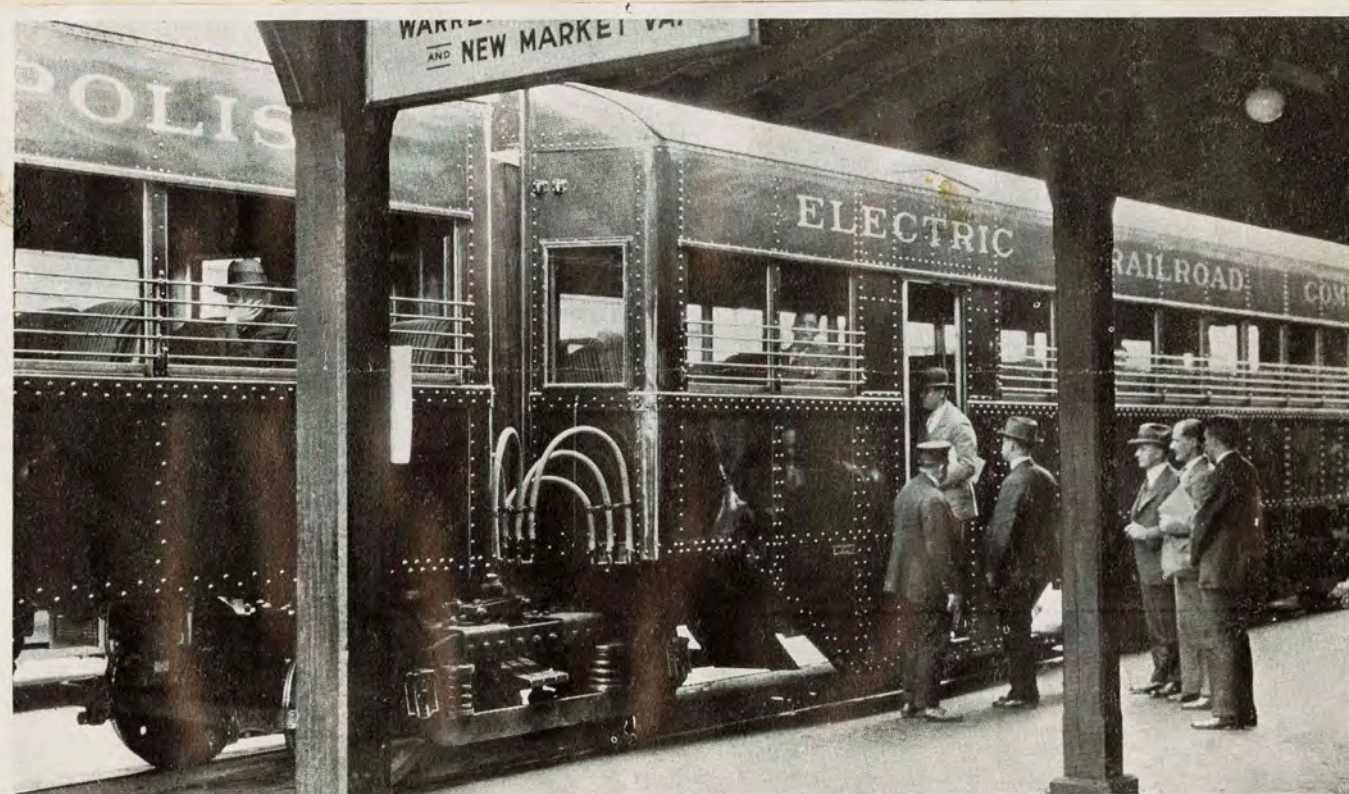
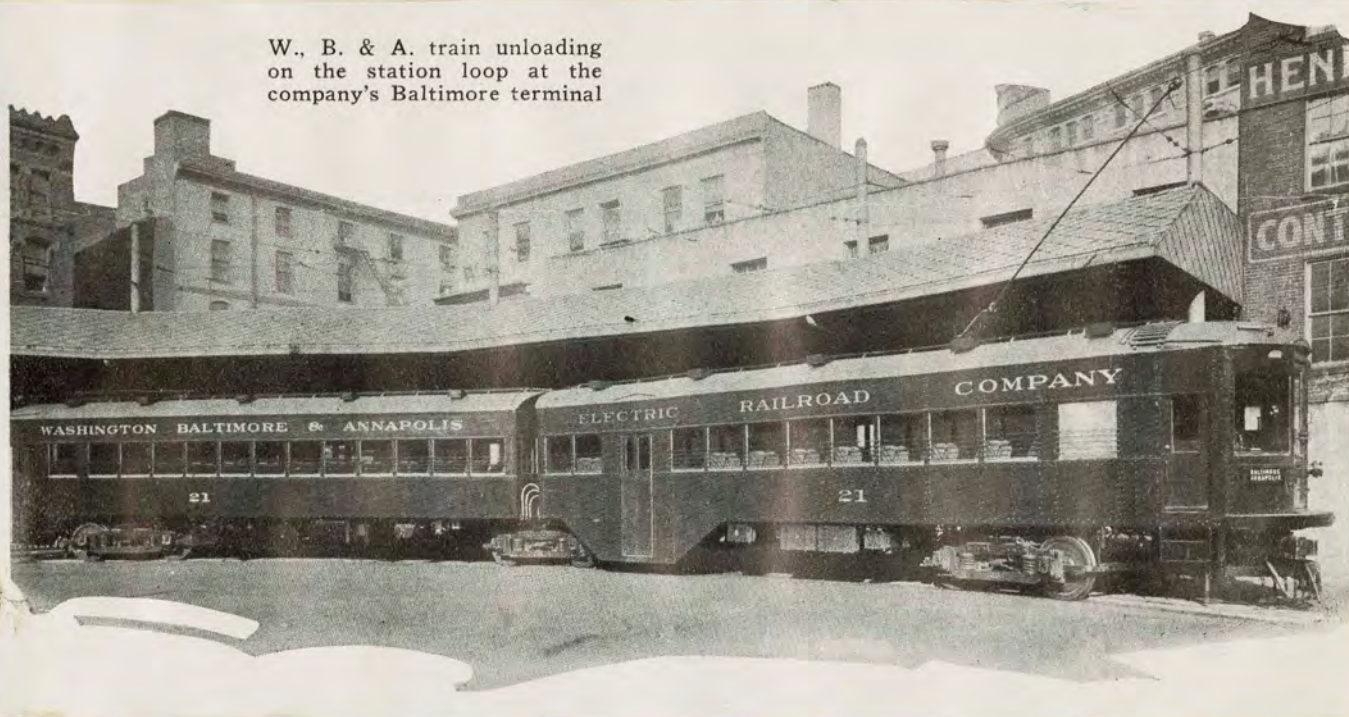
One of the two end trucks before mounting the motors



Center pivot truck without motors but supporting two inner body ends and connecting drum



W., B. & A. train unloading  
on the station loop at the  
company's Baltimore terminal



Passengers boarding one of the ten new articulated cars of the Washington, Baltimore & Annapolis line in the  
company's Washington terminal



### CARS

Description	Equipment	Number
Passenger.....	Electrically Equipped.....	31
Passenger—Parlor Car.....	Electrically Equipped.....	1
Passenger Trailers.....		58
Combination Passenger and Baggage.....	Electrically Equipped.....	39
City Passenger.....	Electrically Equipped.....	1
Freight Motors.....	Electrically Equipped.....	14
Freight Trailers.....		3
Freight Box.....		7
Freight Flat.....		5
Freight Gondola.....		10
Freight Hopper.....		8
Line (3 Construction, 1 Wrecker).....		4
Total.....		181

### MILEAGE TABLE

	On W., B. & A. E. R. R. Co. Tracks	On Tracks Op- erated under Contract	Total
Miles of Single Track.....	73.524	6.667	80.191
Miles of Second Track.....	40.934	6.667	47.601
Miles of Sidings and Turnouts.....	19.2148	-----	19.2148
Total Mileage Operated.....	133.6728	13.334	147.0068

Includes Annapolis Short Line.

### PRESENT OPERATING RESULTS

Below is the statement of earnings for the five years, 1916 to 1920 inclusive:

	1920	1919	1918	1917	1916
Gross earnings, all sources.....	\$2,232,675	\$2,256,025	\$3,047,156	\$1,598,592	\$972,223
Operating expenses and taxes.....	1,645,769	1,641,423	2,263,708	867,648	562,550
Applicable to Bond interest.....	586,906	614,602	783,448	730,944	409,673
Interest on Bonds.....	268,450	266,833	257,078	257,200	256,436
Net income available for Dividends	318,456	347,769	526,370	473,744	153,237
Dividends on Preferred Stock.....	105,555	91,897	87,345	87,360	87,378
Balance available for Dividends on Common Stock.....	212,901	255,872	439,025	386,384	65,859